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COMMUNICATIONS

THE FOURTH CRANIAL NERVE

BY

LEONARD J. KIDD

LONDON

IN the interesting paper on the fourth cranial nerve by Mr. Parsons in the December, 1921, number of this Journal there are three points that seem to need a little criticism. In a reply to a private communication from myself he has kindly asked me to write a paper on that nerve. I hope to show here :—(1) That the decussation of the fourth nerve is not quite complete; in short, that it contains a few uncrossed fibres; (2) that the sixth nerve nucleus gives origin to uncrossed fibres exclusively, all of which pass out in the homolateral sixth nerve; and (3) that the mesencephalic trigeminal root is not motor, and cannot therefore form the visceral motor component of the fourth cranial nerve. It so happens that a few years ago I wrote two papers[22] which dealt rather fully with all these matters; so I shall give here merely the salient points of those papers. The title of the earlier paper (1910) was :—" The mesencephalic fifth root; the dorsal glosso-pharyngeal nucleus; and the question of an endo-neural afferent ganglionic system." The title of the second paper (1913) was :—" Direct trochlear and crossed oculomotor fibres." I will begin now with the mesencephalic fifth root.

The mesencephalic trigeminal root is of extreme antiquity; it is present and has the same relations in a 13 mm. embryo of the very ancient selachian squalus acanthias as it has in adult man.

Neal figures it* in that embryo rising in the dorsal wall of the mid-brain and passing out in the trigeminus nerve. The root is composed mainly of large fibres which rise in large globular, vesicular nerve-cells situated in the outer part of the roof of the mid-brain; but a minority of the fibres of the mesencephalic fifth root have been shown by Bregmann, Probst, and van Londen to be ascending centripetal fibres. Up to the year 1909 the root was by some observers held to be motor, partly because in many animals it passes out by the motor fifth root and partly because the majority of its fibres (the large ones) had been proved to be centrifugal. But, as it was known that it contains both centrifugal and centripetal fibres, others regarded it as in part motor and in part afferent. These latter observers failed, however, to recognize the truth that the mere fact that a nerve-fibre is centrifugal and degenerates downwards when cut or destroyed does not in the least prove that it is motor in function. In 1909 Johnston[1] threw quite a new light on the function of the mesencephalic fifth root. He pointed out that the large globular, vesicular cells which form the nucleus of origin of the mesencephalic fifth root are developed in the dorsal zone of the neural tube, and are situated in the roof of the mid-brain. Further, he pointed out that all motor nuclei are developed in the ventral zone of the neural tube (the basal lamina of His, senior). From a consideration of these facts he expressed the opinion that the mesencephalic fifth root is afferent. Briefly stated, his teaching was that the cells of the tectum mesencephali and locus coeruleus, from which the fibres of the mesencephalic fifth bundle originate (he is, of course, referring to the centrifugal fibres of that bundle) belong to the same category as the dorsal giant cells of the spinal cord of fishes and amphibians (the cells of Rohon), and are equivalent to peripheral ganglion cells. He thinks it probable that they have been derived from the neural crest during development, having been enclosed in the neural tube as are the giant ganglion cells of the spinal cord. He points out that in Amphioxus a large part of the ganglion cells of the dorsal sensory nerves lie within the central nerve cord. He suggests that the fibres of the mesencephalic fifth bundle are presumably distributed to skin or to muscle-sense organs. A few months later I[22] annexed Johnston's hypothesis that the bundle is afferent, and I quoted evidence which led me to conclude that the cells of origin of the centrifugal fibres of the mesencephalic fifth root form what I called an " endo-neural afferent ganglion." These centrifugal fibres degenerate downwards after section, or destruction by disease, and yet they conduct physiological impulses centripetally. In both these respects they exactly resemble the fibres of any

*H. V. Neal, "Neuromeres and Metameres," *Jl of Morphol.*, 1918, Vol. XXXI, p. 293.

peripheral nerve distally of its dorsal-root ganglion. At the time when my paper was published I was not aware that the mesencephalic fifth root contains some ascending (centripetal) fibres. Clearly, therefore, if my view be right, the so-called mesencephalic fifth " nucleus " is really an endo-neural afferent ganglio-nuclear complex. Its large globular cells which give origin to the centrifugal fibres form the ganglionic part, and the remaining cells form an afferent reception-nucleus for the ascending fibres which pass up the mesencephalic root.

A few days after my paper was in print Otto May and Victor Horsley[2] published their experimental study of the mesencephalic fifth root. They found that " avulsion of the peripheral branches of the mandibular nerve caused chromatolysis of the characteristic cells of the mesencephalic fifth root, a result suggesting that these axons run in the peripheral branches, though examination by the Marchi method has failed to reveal them." They failed to obtain any chromatolysis after avulsion of the ophthalmic or the maxillary divisions of the trigeminus nerve.* They also failed to evoke any motor response in mandibular muscles by means of electrical stimulation of the exposed mesencephalic fifth root. This was by itself enough to prove that the root is not motor, for motor roots give a motor response with the greatest ease and constancy when electrically stimulated. Yet, in spite of this, May and Horsley hesitated to conclude that the root has exclusively afferent functions, although they knew of the opinion previously expressed by Johnston.

Six months later Willems[3] published a paper (1911) on the masticator and mesencephalic trigeminal nuclei of the rabbit, containing an account of his studies on the anatomy, development, and histology of these nuclei, and of his experimental work by the retrograde chromatolysis method. He points out that the masticator nucleus receives all its connections from the mesencephalic nucleus and gives none to it. " The principal protoplasmic prolongation of the vesicular cells has not the characteristic histological structure of a motor cell." He found that avulsion of the muscular branches of the mandibular nerve gave retrograde chromatolysis in only 51 per cent. of the cells of the mesencephalic nucleus. Avulsion of the branch to the mylo-hyoid and anterior digastric gave no cell changes in the mesencephalic fifth nucleus. Other points I need not here dwell upon. Willems concluded that that nucleus is (1) a sensori-motor apparatus, (2) the homologue of a root-ganglion, and (3) what amounts to an " endo-

*I was privately informed by Miss Tozer in 1914 that she and Professor Sherrington did find chromatolysed cells in the mesencephalic fifth nucleus after section of the ophthalmic and the maxillary trunks. But this work has not been published; and I have reason to believe that it never will be.

neural ganglion " (he writes " resté dans les centres "). He discussed Johnston's work and view, but did not try to find out whether any of the centrifugal fibres of the mesencephalic fifth root go to skin or pass down the ophthalmic and the maxillary trunks. Doubtless, he felt this was foreign to the work he had in hand. But I have said enough here to show that, although the superior oblique muscle of the eyeball is developed in the mandibular head cavity of Elasmobranch embryos, the mesencephalic trigeminal root cannot be the visceral motor component of the nervus trochlearis. We are forced, therefore, to conclude that the fourth cranial nerve has now only two out of the four fundamental nerve-components of a segmental nerve, viz. :—(1) Somatic motor, and (2) somatic afferent (Sherrington,[4] and Miss Tozer[5] and Professor Sherrington).

There is embryological, anatomical, pathological and experimental evidence that the fourth cranial nerve contains a few uncrossed fibres. Thus, in 1890 Paul Martin[6] found that in cat embryos the trochlearis nidulus (embryonic nucleus) sends out its neuroblasts first on the same side, whereas its crossed ones are later in appearance. In 1891 Froriep[7] observed in young embryos (16 mm.) of Torpedo Ocellata that the trochlearis nerve receives fibres from both trochlearis niduli. In 1892 Obersteiner[8] described some fibres of the trochlearis nerve as passing ventralwards in traversing the posterior longitudinal bundle. He thought that a certain number of these fibres curve back to join the homolateral trochlearis nerve, whilst the majority pass across the raphe. In 1911 Franz[9] described and figured both crossed and uncrossed trochlearis roots in bony fishes. He found that in some of the fifteen fishes examined the trochlearis has two roots, a dorsal and a ventral, each crossing with its partner. In others only the dorsal trochlearis root is present, in yet others only the ventral. Lophius and Pleuronectes showed some uncrossed trochlearis bundles. In the latter some bundles cross the raphe twice " so that they amount in effect to uncrossed fibres." In 1913 McKibben[10] studied the eye-muscle nerves of twenty-five adult specimens of Necturus Maculosus by the intra vitam methylene blue method. He found great variations in the trochlearis nerve, even occasionally in a single specimen on the two sides of the head. Its root contains from sixteen to twenty-four fibres. Out of these fibres, from four to eight, " seem to enter the nerve uncrossed." But, as these appeared under high magnification to be larger than those which make up the trochlearis nerve, he was inclined to think that they belong to the mesencephalic trigeminal root. There is, then, some uncertainty on this point. In 1897 Siemerling and Boedeker[11] found evidence of the existence of degenerated cells in both trochlearis nuclei in a case where only one superior

oblique muscle was paralyzed. During life the right superior oblique was said to be normal, the left was paresed. Microscopical examination showed atrophy of the right fourth nucleus and of its intramedullary root, with slight degeneration of the left fourth nucleus, but none in its intramedullary root. There was also marked degeneration of the left superior oblique muscle, and slight of the right. At the end of their paper they conclude that the trochlearis crossing is total. In some respects the case seems to be unconvincing. If the right superior oblique was really intact, the left fourth nucleus should have been normal, and the right superior oblique should not have shown any degeneration. As syphilis was present, the possibility of multiple diffuse lesions has to be admitted. It is quite admissible, I own, to hold that this case does not really prove the existence of uncrossed trochlearis fibres in man.

In 1898 van Gehuchten[12] found that after section of the rabbit's fourth cranial nerve chromatolysis occurred in a few cells of the homolateral fourth nucleus. In a later and fuller research[12] (1903) he confirmed the existence of a few direct trochlear fibres in the rabbit. In 1909 van der Schueren[13] found that, after rupture of one trochlear nerve in rabbits, a few cells—a very careful count showed a dozen—were chromatolysed in the homolateral trochlear nucleus, and that a few normal cells were seen in the contralateral trochlear nucleus. The cells which gave origin to the direct (uncrossed) trochlear fibres were distributed, without any apparent order or grouping, throughout the whole extent of the trochlear nucleus. Thus, he confirmed the previous findings of van Gehuchten (1898, 1903) that in the rabbit the trochlear nucleus sends a few direct fibres into the homolateral trochlear nerve. We have proof, then, that a few uncrossed fibres exist in the trochlearis nerve from the ancestors of Elasmobranch fishes up to mammals, and that in cat embryos they appear earlier than the crossed fibres.

In my 1913 paper[22] I quoted a mass of evidence which showed that we have anatomical, experimental and pathological proof of the existence of crossed oculomotor roots and fibres in fishes, amphibians, birds and mammals up to man. And I showed that there is a remarkable agreement among experimentalists that the crossed fibres of the oculomotor nerve come from the dorsal part of the caudal end of the contralateral oculomotor nucleus. Duval[14] (1880) pointed out that the idea of a partial decussation of the oculomotor nerve is a very old one. Thus, this opinion was held by Varolius (1591), Riolan (1649), Vieussens (1685), and Vicq d'Azyr (1805). It was denied by Longet (1842), but was revived by Vulpian and Philippeaux (1853) for mammals, including man.

More than sixty years ago the suggestion was made that lateral conjugate eye-movements are carried out by means of fibres which

the sixth nucleus is alleged to send to the contralateral third nucleus or root for the innervation of the internal rectus muscle in this movement. This theory—which I have called the Duval-Laborde hypothesis—was first brought into prominence by these two writers[15] in 1880, partly owing to their experiments and partly to Duval's anatomical studies. They were also much influenced by certain cases of paralysis of lateral conjugate eye-movements associated with preservation of the power of convergence. In section 3 of my 1913 paper[22] I held that the anatomical work of Duval, and of Duval and Laborde, on this question was not at all convincing. In section 6 of my paper I gave details of six cases that were examined pathologically, viz., that of Féréol (1877),[16] Hughes Bennett and Savill (1889), Gee and Tooth (1898),[17] Spitzer (1899), Bruce[18] (1903), and Siemerling and Boedeker (1897).[11] In Féréol's case there was a tuberculous focus near the origin of the right sixth nerve. He regarded the Duval-Laborde hypothesis as possibly correct. The second case was a worthless one. Gee and Tooth's was very carefully examined. It was a case of bilateral loss of lateral conjugate eye-movements, but loss of convergence was also present, and the left sixth nucleus was uninjured. The writers suggested (quite rightly, I think) that "it may be regarded as possible that a lesion involving the division of the posterior longitudinal bundle on both sides would result in paralysis of conjugate deviation on both sides, even though the sixth nuclei were unaffected." In Spitzer's case there was degeneration in the posterior longitudinal bundle. No comment is needed. Bruce's case was one of double paralysis of lateral conjugate eye-movements, which he studied with his usual accuracy and caution. It is clear that he did not blindly accept the Duval-Laborde hypothesis, for he expressly suggests a particular experiment as necessary. I will show presently that van der Schueren performed this experiment in the rabbit a few years later and disproved that hypothesis, for the rabbit at any rate.

Siemerling and Boedeker[11] denied the existence of a lateral conjugate eye-movement centre in the sixth nucleus. They recorded a case of bilateral degeneration of the sixth nuclei in which, during life, there had been no paralysis whatever of the internal recti muscles. We cannot, then, hold that in man the sixth nucleus sends any fibres to the opposite third nucleus or root for the conjugate inward movement of the internal rectus muscle in the associated lateral eye-movements. Duval and Laborde[15] (1880) performed stimulation and destruction experiments in the region of the eminentia teres, chiefly in dogs, but also in cats and monkeys. They thus obtained various deviations of the eyes. But their experiments cannot be taken seriously, for

they actually believed that their stimulation and destruction was limited to the sixth nucleus. We now know, thanks to the labours of many experimenters up to van der Schueren (1913), that ascending vestibulo-ocular fibres pass up in the posterior longitudinal bundle, some of which pass through the sixth nucleus. Clearly, therefore, Duval and Laborde's experimental procedures involved these ascending fibres as well as the sixth nucleus. In 1881 von Gudden[19] found that, after extirpation of the three eye-muscle nerves of newly-born rabbits, there was complete atrophy of the contralateral fourth nucleus. He concluded that all the trochlear fibres are crossed, some of the oculomotor crossed, and all of the abducens nerve direct. In 1909 van der Schueren[13] established the following facts in rabbits:—(1) After section of the third, fourth and sixth nerves of one side he found, a few days later, that there was chromatolysis of all the cells of the homolateral sixth nucleus, and none whatever in the contralateral sixth nucleus. It is obvious that, if the sixth nucleus sent any fibres to the contralateral third nucleus or root, he would have found chromatolysis of some of the cells of the sixth nucleus on the side opposite to his section of the third nerve. (2) Section of one sixth was followed by chromatolysis of all the cells of the homolateral sixth nucleus. Therefore all the cells of the sixth nucleus give origin to root-fibres of the homolateral sixth nerve. (3) He also established the facts that, in the rabbit: (*a*) the posterior longitudinal bundle in its course between the level of the sixth nucleus and the fourth and third nerves contains ascending fibres which are connected with the cells of the homolateral fourth and third nuclei; (*b*) that bundle does not contain any fibres which pass into the peripheral part of the fourth or the third nerve of either side; (*c*) the sixth nucleus sends no fibres into the posterior longitudinal bundle; and (*d*) no neurones connect the sixth nucleus with the fourth and third nuclei. In his recent paper (1913) on the posterior longitudinal bundle he again proves the falsehood of the Duval-Laborde hypothesis for the rabbit. We may sum up this question thus:—(1) In all those cases of loss of lateral conjugate eye-movement, accompanied by preservation of the action of the contralateral internal rectus muscle in convergence, which have been carefully examined pathologically, we find evidence of the presence of degenerated fibres in the posterior longitudinal bundle; (2) the case of Siemerling and Boedeker directly negatives the Duval-Laborde hypothesis for man; (3) experiments show that all the cells of the rabbit's sixth nucleus are radicular. It sends no fibres into the posterior longitudinal bundle to the contralateral oculomotor nucleus or root; (4) whatever may be the mechanism of the lateral conjugate eye-movements of man and the rabbit, so far as the brain-stem is concerned, it is not by means of the

Duval-Laborde fibres, for such fibres have no existence. Thirty years ago van Gehuchten[12] expressed the opinion that the posterior longitudinal bundle seems to be sufficient to carry out the lateral conjugate eye-movements by means of the fibres which pass in that bundle to the various ocular nuclei, and many authors have held the same opinion. In my 1913 paper I stated that there are only two kinds of lesions which can cause effects anatomically and functionally limited to the cells of the sixth nucleus, viz. :— (1) A slow, primary degeneration of its cells; and (2) a retrograde, secondary degeneration of its cells due to a lesion of the homolateral sixth root or nerve. All gross lesions, such as tumour, softening, or haemorrhage, which involve one sixth nucleus, involve also of necessity some of the ascending vestibulo-ocular fibres. A lesion, then, which is strictly limited to the cells of one sixth nucleus, gives exactly the same clinical picture as one which involves the motor fibres of the sixth root or nerve; but a combined lesion of the sixth nucleus and the posterior longitudinal bundle gives rise to loss or diminution of lateral conjugate eye-movement to the side of the involved sixth nucleus, with or without (most commonly with) preservation of the convergence action of the contralateral internal rectus muscle. And, finally, if the Duval-Laborde hypothesis were true we should find in every case of experimental section of one third nerve, and in at any rate some cases of complete unilateral third nerve paralysis in man, that necropsy would show the presence of chromatolysis of some of the cells of the contralateral sixth nucleus; but such changes have, as far as I know, never been seen by any experimentalist or pathologist. I may add that a lesion strictly limited to the cells of one fourth nucleus will give almost complete paralysis of the contralateral superior oblique muscle, together with a very slight paresis of the homolateral superior oblique; and the latter might easily be overlooked. I pointed out in my 1913 paper that ignorance of the fact that the fourth nerve contains some direct fibres can lead to error in diagnosis. A few years ago I heard a very distinguished ophthalmic surgeon relate the case of a man who showed an isolated complete palsy of one superior oblique muscle, which came on suddenly during a paroxysm of coughing in pertussis. The surgeon diagnosed a haemorrhage of the opposite fourth nucleus. But there can be no reasonable doubt that the haemorrhage occurred within the sheath of the homolateral fourth nerve trunk. We can now see how it comes about that a pure sixth nuclear lesion gives unilateral (homolateral) signs alone, whereas a pure trochlear or oculomotor nuclear lesion of necessity gives bilateral palsies or pareses. In my opinion the vast majority of cases of ocular palsies are due to fascicular, radicular, or radiculo-nuclear lesions, and only a small minority to purely nuclear lesions.

When we consider the meaning of direct trochlear and crossed oculomotor fibres we see that the fundamental error has been made of comparing the fourth nerve with the third nerve. The true comparison is between the fourth nerve and the branch of the third nerve which supplies the inferior oblique muscle. We have to remember that, whereas the fourth nerve supplies only one muscle, the third nerve supplies four eye-muscles and a large oculo-palpebral muscle, the levator palpebrae superioris. In 1904 I surmised* that in the laterally placed lateral eyes of vertebrates the two oblique muscles were primitively purely wheel-rotators and the upper and lower recti were purely vertical movers of the eyeball (strictly speaking, of the cornea). At a later stage—which may have come quickly—the obliques and these two recti received new fibres and new functions with the development of inward movements of the eyeballs. In adduction, then, the obliques became vertical movers and the two recti wheel-rotators. Now, primitively the two eyes moved independently of each other, and originally each hemisphere governed the movements of the opposite eye. Thus the upper path was crossed, the lower direct. We must conceive each separate field of fixation in this primitive animal as divided into a right and a left half of the mid-line of vision of each eye. Probably the earliest possessors of lateral eyes were relatively defenceless animals which sought safety in escape from their overtaking enemies. If that be admitted, the earliest eye-movements were backward movements performed by each external rectus, aided for upward and backward movements by the superior rectus and inferior oblique, and for downward and backward movements by the inferior rectus and superior oblique. All this was performed by a crossed upper nerve-path and a direct lower path. It follows that as in the abducted position the upper and lower recti have much greater resistance to overcome in producing upward and downward movements than the obliques have to meet in producing wheel-movements, the number of direct fibres going to the two recti was of necessity far greater than was needed in the case of the two obliques. Hence the obliques received very few direct fibres, and the upper and lower recti a very much larger number than the obliques. But things were quite different when this primitive animal began to need (or at any rate to acquire) adduction movements of each eyeball. These movements were really right-sided movements of the left eye, and *vice versâ*. For convenience we may call a muscle a homonymous one when it carries out a movement on its own side, and heteronymous when it performs a movement on the opposite side. The upper nerve-path still remained a crossed one, therefore these

* *Rev. Neurol. and Psychiatry*, 1904, Vol. II, p. 799. "Vertical eye-movement testing in the positions of abduction and adduction."

adduction movements of each eye were governed by the homolateral hemisphere. Clearly, therefore, a crossed lower path had to be evolved in order that these heteronymous muscular actions should be capable of performance. A little reasoning will show that the internal rectus muscle received crossed fibres, the two obliques a very large accession of crossed fibres, and the upper and lower recti a very small accession of crossed fibres. The reason for this was, of course, that in adduction the obliques have to contract against marked muscular resistance, and therefore need a large number of crossed nerve-fibres, whereas the upper and the lower recti have very little resistance to overcome, and therefore need very few crossed nerve-fibres. Of course, we all recognize that it is not easy to understand the exact stages by which the primitive independently acting eyeballs of lower vertebrates arrived at the conjugated actions of higher forms. But one thing is clear:—If the upper path be wholly crossed, the lower path must be double in the case of the two obliques and the upper and lower recti, otherwise the eye-muscles would not be able to perform the various eye-movements of mammals (especially man) as we know them. If, on the other hand, the upper path be double, a single nucleo-muscular path to these four muscles is sufficient. With regard to the internal rectus muscle, we have evidence that it does not receive any crossed fibres from the contralateral sixth nucleus. I feel convinced, however, that all its fibres are crossed, and that all its motor fibres come from the contralateral third nucleus. My reason is that it is entirely a heteronymous muscle, not only in the action of conjugate lateral eye-movements to the opposite side, but also in convergence. In the latter act the left internal rectus performs a right-sided movement, i.e., it acts as a heteronymous muscle. It is believed that in man the cortico-nuclear path is wholly crossed. In the act of convergence each hemisphere governs the action of the homolateral internal rectus muscle by means of the crossed fibres which pass from the contralateral third nucleus to the muscle just named. The same thing happens in the actions of convergence below or above the horizontal plane. In these actions each hemisphere acts on the superior or the inferior oblique of its own side by means of the crossed fibres which pass to these muscles from the fourth and the third nucleus respectively. As to the levator palpebrae muscle, the only reason I know of which suggests that it probably receives some crossed fibres from the contralateral third nucleus is the fact that electrical stimulation of a small area of the cerebral cortex gives slight movements of the homolateral eyelid. (I reject van Biervliet's finding* that all, or nearly all of the fibres received by the levator palpebrae superioris

* J. van Biervliet, *La Cellule*, 1899, Vol XVI, p. 1.

are crossed, as it seems to me to amount to an absurdity.) In the final conclusion of my 1913 paper I summed up the question thus:—" As the upper path from the cerebral cortex to the nuclei of the eye-muscle nerves and to the nuclei of the motor nerves of the sterno-mastoid muscle is believed to be wholly crossed, the lower path has to be a double one to the two obliques and the upper and lower recti muscles of the eyeball, and also to the sterno-mastoid muscle. If it were not so, the eye-movements could not be carried out in the way we know they are performed. If, however, the upper path were double, a single lower path would be sufficient, and there could then be no possible need for any crossed nerve-fibres in either the third or the fourth nerves." To this I may add that if we accepted the doctrine (of von Gudden and others) that all trochlearis fibres are crossed, all abducens fibres direct, and some oculomotor fibres crossed, it would still be true that the eye-movements of man could not be performed by such a lower mechanism if the upper nerve-path is wholly crossed, and it is equally true that by none of the various schemata—not even by Bernheimer's or the more recent one of Brouwer—would the eye-movements be capable of performance.

The subject of the embryology of the fourth nerve and of the other ocular nerves and ocular muscles has been so well expounded by Parsons in his recent paper on the fourth cranial nerve that I have but little to add. That little, however, is of much interest in relation to some of the points presented in my 1904 and 1913 papers. Thus, in 1902 Lamb[20] arrived at the same conclusions as to the development of the eye muscles in Acanthias as Miss Platt* did in 1891. He confirmed the existence of her large " muscle E," and he agreed with her that it degenerates and disappears in the ontogeny. This he found to occur between the 19 mm. and 26 mm. stage. He found that the inferior oblique is the first of the oculomotor muscles to be differentiated. The oculomotor nerve is differentiated at an 8 mm. stage, the abducens at a 10 mm. stage (Neal, 1898), and the trochlearis nerve not until a 21-22 mm. stage. The trochlearis is the last cranial nerve to be differentiated. Lamb points out that in Acanthias the original direction of all the eye muscles, including " muscle E," is longitudinal. This seems to him to represent an originally flexible (jointed) condition of the head. He writes:—" It seems to me improbable that the present musculature of the eye in Acanthias is the primitive one for several reasons:—(1) The adult condition is reached only after the constituent muscles have undergone rather extensive alterations in form and transfer of position; (2) the eye-muscles do not all arise equally early, nor do they reach their

*J. B. Platt, *Jl. of Morphol.*, 1891, Vol. V.

definitive condition at the same time; (3) before some of the permanent eye-muscles are formed, one muscle (muscle E), which later disappears, reaches an advanced state of development. This muscle, from its form and position, must either have once been functionally connected with the eye or with some structure now lost, and of which not even an embryonic rudiment is known." " If, then, the present musculature of the eye is not the primitive one, it becomes an interesting question to inquire if the embryonic development will indicate any stages in the phylogenetic development. Two such stages, it seems to me, are indicated :--(1) A stage, where, if any eye-musculature existed, it was furnished by the anterior somite " (I take it he is referring here to Miss Platt's " cavity A "). " This is indicated, first by the fact that this somite is the only one which from its topographical relations could move the eye; and, second, the longitudinal and serial arrangement of the remaining muscle Anlagen indicate a jointed condition of the head and consequently a functional activity on the part of these muscles which would preclude any connection with the eye. (2) A stage at which four muscles moved the eye. These were the superior oblique, the external rectus, the inferior oblique, and " muscle E." These four muscles were arranged radially. " Muscle E " and the inferior oblique opposed each other, the former pulling the back of the eye dorsally, the latter ventrally. The superior oblique and the external rectus opposed each other, the former pulling the back of the eye forward, the latter backwards. This stage is reached in ontogeny at a length of 21-22 mm. (Figs. 4, 5, 6). The four muscles then have the rectangular radial arrangement described above. They have all reached approximately the same degree of differentiation, which is far in advance of the three remaining eye-muscles."

Neal (1918) in his paper[21] on " The history of the eye-muscles," published his evidence, from his developmental studies, that the mandibular cavity participates in the formation of the external rectus. This fact was asserted by Dohrn (1904) and by Neal (1909); but, as Neal points out, neither published any figures or other evidence to support his assertion. On the question of Miss Platt's " muscle E " he finds that she and Lamb were both mistaken in describing it as degenerating and disappearing. The former gives no evidence of any histological changes manifested by degenerating muscle cells. Neal shows that " in Squalus Acanthias embryos of 18-24 mm. the anlage of the external rectus muscle shows two easily distinguishable elements, one (anterior) derived from the myotome of the mandibular cavity which is recognizable as ' muscle E,' the other (posterior) formed from the myotome of the hyoid cavity. The two elements differ, not only in their staining properties, but the distinction between the

two may be made out, as Miss Platt has stated, through the presence of a limiting membrane bounding the myotome of the third (hyoid) head-cavity." The difficulty of distinguishing the two elements becomes increasingly greater as development goes on. Ultimately, the bounding membrane disappears altogether. Neal shows clearly that " what disappears is not the mandibular element, but the limiting membrane bounding the hyoid element, making it increasingly difficult and finally impossible to distinguish the two. Of the disintegration or degeneration of the muscle cells of ' muscle E ' there is not the slightest evidence. On the contrary, in the stages during which degeneration has been said to occur, the embryonic muscle cells of both elements of the external rectus muscle undergo similar progressive differentiation as elongated spindle-shaped muscle fibres. In both, myofibrillae are visible in Squalus* embryos of 45 mm., and transverse striae in embryos of 100 mm."

According to Neal, " the history of the eye-muscles is the history of the transformation of the first three myotomes of an Amphioxus-like ancestor into the definitive six eye-muscles of man. This history may be very briefly summarized:—Primarily, as in Amphioxus, the three anterior myotomes were members of an unbroken series of segmented muscles extending throughout the entire length of the body. When lateral line organs and enlarged cranial ganglia associated with them made their appearance, the anterior myotomes became split lengthwise into dorsal and ventral moieties. Further separation and displacement followed the enlargement of the optic and otic vesicles. In this way eventually two sets of muscles, one dorsal and one ventral, were brought in close proximity to the enlarging optic vesicles with which they became functionally associated. How these two sets of muscles became gradually transformed into the eye-muscles is revealed by their ontogenesis in Elasmobranchs. Each of the divisions (dorsal and ventral) of the first myotome divides again, thus forming the four muscles innervated by the oculomotor nerve. The second myotome undergoes no further subdivision. Its dorsal moiety, however, becomes the superior oblique muscle and is innervated by the trochlearis nerve. Its ventral portion, however, unites with the third myotome to form the external rectus muscle and becomes innervated by the abducens nerve. The dorsal moiety of the third myotome does not differentiate muscle fibres. Like the myotomes of somites 4, 5, and 6, it has disappeared phylogenetically, leaving the eye-muscles as an isolated group unconnected with the post-otic myotomes." At this point I may mention that Neal, in his

*The name Squalus, or Squalus Acanthias, was, I believe, the name originally given by Linnæus to the interesting Selachian which most modern embryologists describe under its later name Acanthias Vulgaris.

paper on " The morphology of the eye-muscle nerves " (1914), points out that in the Torpedinidae the so-called ganglia of the trochlearis " are irregular fragments of the neural crest lying in the region through which the trochlearis grows " (Dohrn). But in the Squalidae (Neal) the trochlear anlage has no such relations to irregular fragments of the neural crest. But in Squalus Acanthias the trochlearis has relations with cell masses that are really sympathetic ganglia (these are figured by Neal).

In conclusion, something must be said about the possible interpretation of the dorsal chiasma of the trochlearis nerve. On this I have nothing original to offer, but I will refer to two explanations that have been offered in addition to those mentioned by Parsons in his December, 1921, paper in this Journal. In 1905 Johnston wrote* thus (p. 210) :—" The course of the root fibres dorsally through the brain wall may be due to the course of the fibre-tracts through which they run. The position of the nucleus of the nerve relative to the tracts which form the ansulate commissure in typical fishes suggests strongly that the axons from the cells of the trochlearis nucleus may have followed some of these bundles as the path of least resistance. The tracts between the tectum opticum and base of the oblongata, the tracts between the inferior lobes and the cerebellum, and others, all running more or less dorso-ventrally in the side wall of the brain and decussating ventrally at the level of the trochlearis nucleus—these bundles, which lie ectal to the nucleus of the trochlearis, may have constituted an effective barrier to the axons of the trochlearis in their attempt to reach the ventro-lateral surface of the brain. The axons may then have turned upwards along the ental surface of these bundles until they reached the dorsal surface of the brain. If the fibres were thus directed in their course they would be carried to the mid-dorsal line before gaining an exit from the brain, and if they then grew straight on they would pass to the opposite side."

Neal[21] (1914) offers the following suggestion in explanation of the dorsal chiasma of the trochlearis :—" Figure 82 of this paper suggests two possible phylogenetic stages in the development of the trochlear chiasma. An earlier stage is represented on the left of the diagram, and a later stage, corresponding essentially to that seen in some Elasmobranch embryos, is shown on the right. It is assumed that originally the trochlear, as a somatic motor nerve, was distributed to the myotome of the second somite of its own side after the fashion of typical somatic motor nerves, and

*Owing to the haste with which I wrote this paper I have not had time to verify this reference given by Neal. Johnston wrote two papers in 1905, both of which I know. The first was on the morphology of the vetebrate head, etc., etc., in the *Jl. of Comparative Neurology*, 1905, Vol. XV; the second was on the cranial nerve-components of Petromyzon in the *Morphol. Jahrbuch*, 1905, Vol. XXXIV. Probably the reference given by Neal as " Johnston (1905), p. 210 " refers to the first paper.

that this myotome, when fully developed, extended dorsally to form a union or interdigitation with the antimeric myotome. As Fürbringer has correctly stated, no skeletal structures would prevent the extension of fibres across the median plane. It may be imagined that this extension of muscle fibres across the median plane was correlated with the muscular development of the prostomial region. Petromyzon still shows (Fig. 77) the extension of myotomes into this region. Under such conditions slight variations in the length of the nerve fibres which grow to connect with these muscles might bring about a peripheral chiasma. The possibility that such muscles had connections with the epiphysis is not excluded, but such a supposition does not seem necessary. Changes in the extension and direction of growth of muscle and nerve fibres in this region may have been correlated with the development of the cephalic flexure which would seem to require some adjustment of the muscles since the fore-brain and mid-brain regions were flexed into a more ventral position. The final result of the flexure, however, appears to have been a shifting of those portions of the musculature which persisted in this region into a more ventral position and a separation of the muscles which had been opposed in the median plane above the brain wall."

" The growth and great enlargement of the lateral eyes also brought about changes in the (van Wijhe's) second myotome which became split into dorsal and ventral moieties (my. 2 v.l., my. 2 m., my. 2 d.l.) in precisely the same way as occurs ontogenetically in the post-otic muscles of Petromyzon as a result of the growth of the otic vesicle (Figs. 78, 79). It may be assumed that, as in the latter case, the median portion of the myotome degenerated, together with its branch of the somatic motor root (trochlear nerve), while the lateral moiety became innervated by a branch of the abducens (Fig. 82, abd.). The dorsal moiety, however, retained its connection with the trochlear nerve, and possibly also with fibres from both sides of the brain, by means of a dorsal peripheral chiasma. Then, when later this dorsal moiety degenerated with the exception of that portion which became attached to the eyeball to form the superior oblique muscle the result would be essentially the conditions that obtain to-day in those forms of Selachian embryos in which a peripheral chiasma persists (Fig. B., p. 25), and are shown on the right hand side of the diagram " (i.e., Neal's Fig. 82). " It is necessary, however, to assume that phylogenetically the chiasma came to be more and more central, and that gradually the fibres of the trochlear nerve became exclusively crossed fibres. What factors determine the survival of the crossed fibres and the elimination of the direct is no less mysterious than those which have produced the ventral chiasma of the eye and the pons. Possibly purely mechanical conditions of the sort

suggested by the writer ('98) and by Johnston ('05) are responsible. All who have discussed the chiasma agree in one essential point—namely, that the chiasma of the trochlear is secondary and that it constitutes a coenogenetic modification of a somatic motor nerve. Therefore its existence does not affect our views of its morphology." If the view of the fourth cranial nerve presented here by me be correct, or even in part correct, I think we must conclude that the peculiarities which have been looked on as marking it out from all other nerves are, for the most part at any rate, more apparent than real. Of all the suggestions as to the meaning of the dorsal chiasma of the trochlearis I like Neal's the best, although he does write of the elimination of its direct fibres. However, he and I agree that they were the primary ones.

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AFTER-TREATMENT OF SMALL FLAP SCLEROTOMY

BY

LIEUT.-COLONEL H. HERBERT, I.M.S. (retd.)

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THERE has always been something elusive in small flap sclerotomy. There has been no sufficient explanation of the very variable results obtained, both as regards the individual cases of any one surgeon, and in comparing the averages of different surgeons. And one has often felt the need of some means of increasing the effect of an ill-cut flap.

Apparently a reasonably ample explanation has been found, and much of the necessary aid supplied, in Cruise's after-treatment by the application of finger pressure to the eye *from the beginning*, to " force up the little trap-door to prevent immediate healing." See *Trans. Ophthal. Soc., U.K.*, Vol. XXXVIII (1918), p. 247, and Vol. XLI (1921), p. 249.

The same principle of very early interference with healing, applied differently, seems possibly to account for the comparative success obtained throughout by Laws in Nottingham. But it has not been applied sufficiently and of set purpose. It has been the practice there to get the patient out of bed on the day after operation, going about the wards, and to discharge him from hospital or nursing home often within a week. Thus there have been almost from the beginning more or less frequent blinking movements, probably in some cases nearly as effectual as the more powerful, but infrequent use of the surgeon's or nurse's finger.

At first I was not much impressed by Cruise's statements, because I had frequently used massage with very little effect, beginning too late. The application of gentle sustained finger pressure through the lower lid may be begun on the afternoon or evening of the operation day, and repeated two or three times daily, partly emptying the anterior chamber. Excessive use of this pressure may be expected possibly to increase the number of partly fistulous cicatrices, but such scars from this operation do not seem to lead to late infection.

Pressure may prove ineffectual and inadvisable in case of very shallow chamber with detachment of the choroid, but this condition is seldom seen after this operation.

After the first few hours the patient should be encouraged to keep his eyes open, and to blink frequently. A pad may be required for the first night or two over the operated eye, but omitted during the day, a shield only being worn.

It is a little difficult now, after so many years, to appreciate the value of this very simple and obvious after-treatment. It makes

all the difference between failure and success in some eyes. As Cruise has found, it ensures the success of the operation in the considerable majority of the primary glaucomas needing operative treatment in this country. I recently suggested restricting the small flap operation to cases in which the plus tension could still be reduced by eserin, in order to eliminate failures. This restriction has already been proved both unnecessary and, as in the instance here given, unavailing.

I operated on the right eye of a patient over two years ago. The tension was readily reducible to normal, but loss of visual field had taken place quite up to the fixation point without the slightest warning to the patient. The left eye was then normal, but shortly afterwards a scotoma was found with a moderate rise of tension. Owing to the insidious nature of the case, as seen in the other eye, operation was performed; and it had to be repeated eleven months later. Recently the tension of both eyes was found slightly raised again, with a little further loss of visual fields. Both eyes have been operated upon together, and the correct after-treatment applied, as above. The difference in the immediate result from that of the former operations has been very noticeable.

The case was at first quite a puzzle to me; I did not realise that the earlier operations failed simply through the excessive anxiety of the patient and his relatives to avoid the slightest injury to the eyes. The patient was extraordinarily careful always to keep still with the eyes closed after the operations.

I suggest that some of the surgeons in this country who are still pleased with trephining are too easily satisfied. One sees some shockingly dangerous-looking results, in which the elevated remains of conjunctiva over the dark scleral opening become progressively thinner. However familiar such conditions may have been in the past, one cannot now rest content with any method which unnecessarily risks their formation.

There has recently been a limited return to the small flap operation. With the help of this after-treatment the movement may be stimulated into a widespread revival. I do not suggest that this is the last word in the glaucoma problem. But it may mean the partial practical settlement of the question for a number of years, till possibly the technical detail is found which is needed to make " ideal " sclerotomy* acceptable. There will always, however, be some severe advanced glaucomas in which any sclero-corneal wound free from iris-inclusion will heal more or less firmly. These demand other treatment.

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*Proc. Roy. Soc. Med. (Sec. Ophth.), 1914, p. 127, and *Trans. Ophth. Soc., U.K.*, 1919, p. 226.

TWO CASES OF THROMBOSIS OF THE RETINAL VEIN, ONE SHOWING A HOLE, THE OTHER A STAR AT THE MACULA*

BY

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LONDON

THE pathology of holes at the macula is a subject which, from time to time, has excited a good deal of attention and has been discussed at some length by the late Mr. George Coats in his paper in the R.L.O.H. Reports, Vol XVII, Part I, in which he summarises the various theories which have been put forward to account for the condition.

There is first the theory of Menteith Ogilvie, who accounts for the traumatic origin of a hole at the macula by stating that there are two factors concerned :—

(*a*) The retina is thinnest at the fovea and thicker around it than elsewhere.

(*b*) That waves of disturbance passing through the eye meet at the posterior pole and tear the fovea by " contre coup."

Fuchs attributes it in traumatic cases to a mild form of traumatic retinitis, the very mild toxic stimulus, reaching the retina from the anterior part of the eye, causing instead of exudation of pus, a slight serous exudate which ruptures the membrana limitans externa and so causes the appearance of a macular hole.

Coats supports the theory of oedema being the underlying cause of macular holes, stating that a hole has never been observed sooner than 60 hours after an injury, and, on the other hand, that opacity of the retina without a hole has been observed after injury in a case in which a hole subsequently developed. Also, that oedema of the retina and subsequent formation of a hole have been observed in cases where there had been no injury.

A year after the publication of this paper, however, Kipp and Alt, in the *American Journal of Ophthalmology* for August, 1908, reported the following case.

A boy was shot through the orbit, the bullet passing behind the eye, tearing the optic nerve and its sheaths, and entering the skull. He was seen on the day following, when the retina was noted to be whiteish and the vessels narrow, except for a vein passing from the macula to the disc. At the macula was a deep red round spot, one third P.D. Two days later the retina was more opaque and the blood vessels were fuller. Four days later the eye was excised and sections through the macula showed a large hole bounded by swollen retinal tissue. The choroidal vessels, especi-

*Read before the Section of Ophthalmology of the Royal Society of Medicine, on December 2, 1921.

ally near the posterior pole, were very hyperaemic and distended, and evidences of oedema were visible everywhere. Arguing from this case, these authors consider that the retina at the macula can be torn by " contre coup," and state, moreover, that holes at the macula seem to be caused without exception by injuries to the orbit or eyeball, during which a contusion of the eyeball takes place.

The reason why I thought that the following cases would be of interest is, that especially in the first case, they show, in an almost

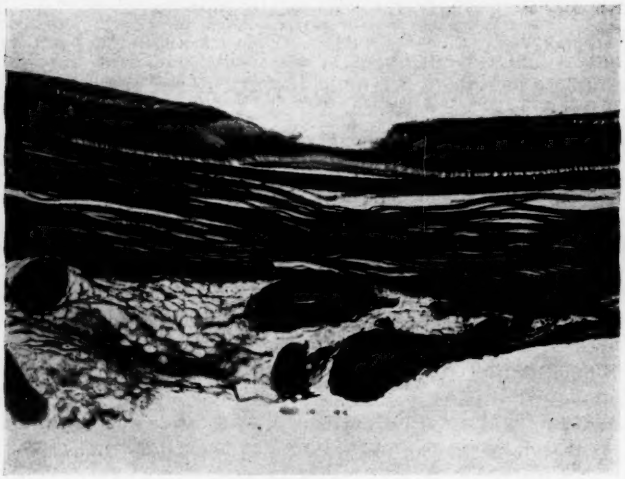


FIG. 1.

diagrammatic fashion, the dependence of the formation of a hole at the macula on the occurrence of sub-retinal oedema.

The salient points in the history are as follows :—

Age, 62 (female).

Sight began to fail 14 years ago, recommended to hospital and had teeth extracted.

Pains in the head 1919-1920. Severe pain August, 1920, and continuous more or less till excision in July, 1921, for absolute glaucoma.

She had a fall 30 years ago and blacked both eyes, but sight was not affected. Clinical examination showed a large corneal nebula with a few vessels. No perception of light. T+1. V. in other eye, with correction, =6/9. The eye was frozen in the usual way and bisected horizontally. On examination with the loupe there

was seen a small but quite definite hole at the macula, on which parallax could be obtained. Microscopical examination of other parts of the excised eye showed the following changes:—

A slightly cellular exudate adherent to the posterior surface of the cornea in places.

Albumin in the angles of the anterior chamber.

Hyaline and faintly cellular exudate passing round the lens and causing an adhesion of the iris to it.

No cupping of the disc, and a thrombosed vein near its margin.

Serial celloidin sections were made of the disc and macula, and

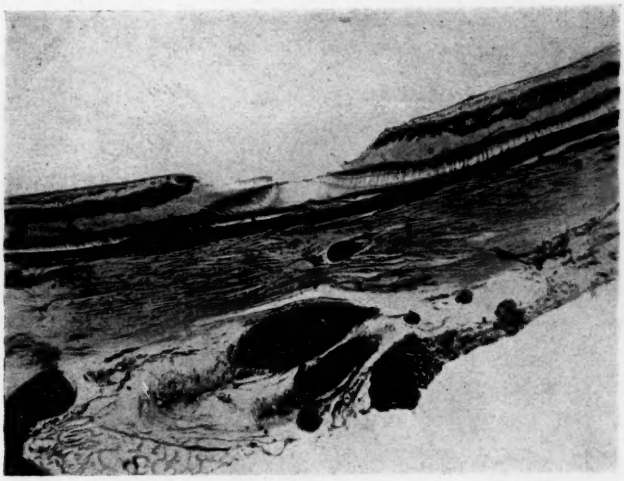


FIG. 2.

some of these are shown in the microphotographs accompanying this paper.

Remarks on sections:—

1. The macular region is shown here and one notices:—

(i) Absence of inner nuclear layer and inner reticular layer.

(ii) That the retinal pigment layer is separated from the inner layer of the choroid, a condition not present in other parts of the specimen.

(iii) That the rods are fairly well preserved, but that between them and the pigment layer is a thin layer of structureless material, presumably oedematous fluid, fixed by hardening reagents.

(iv) That there is a certain amount of oedema in the outer molecular layer of the peri-macular region.

2. This is two sections nearer the fovea and one notices:—

(i) Absence of the outer nuclear layer.

(ii) The layer of rods and cones is pushed forward by the accumulation of fluid behind.

(iii) That in this fluid there has developed a cyst, whose anterior wall is clearly formed only by the membrana limitans externa of the retina, i.e., the layer of rods over it has disappeared.

(iv) The area of separation of retinal pigment layer alluded to above is also present.

3. This section would appear to be at the fovea; it presents the

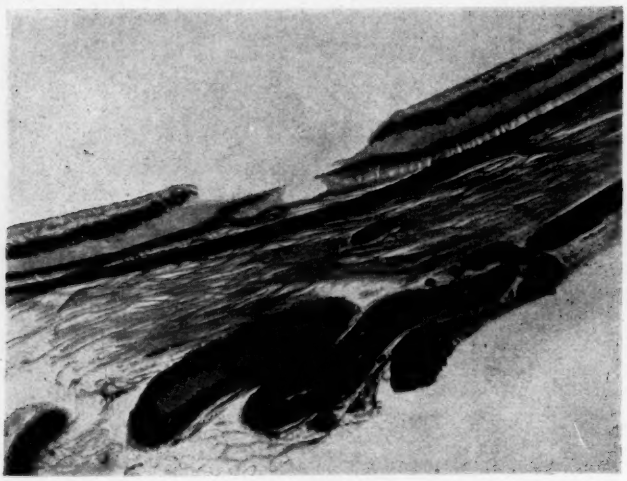


FIG. 3.

same characteristics as before, except that the anterior wall of the cyst is not present, thus causing the formation of a hole.

The feature to which I would call special attention in these sections is that the cyst is formed, not in the retina but in the accumulation of oedematous material between the membrana limitans externa and the retinal pigment layer. And, secondly, that in consequence of the presence of this cyst, the outer layer of the retina would appear to undergo a degenerative process, thus allowing the formation of a hole.

Second case.—This patient had been blind in the R.E. for five years. Fourteen days before admission it became red and painful. T + 1. No perception of light. Eye excised. Urine contained no sugar or albumin.

The eye was frozen and bisected.

Pathological examination showed the following points :—

(i) The anterior chamber contained partly organized blood clot, which blocked its angles. Posterior synechiae were present and at the periphery the iris was atrophic and adherent to the posterior surface of the cornea. A faint cyclitic exudate was present round the lens, which showed cataractous changes. Round the cupped disc was a zone of haemorrhages and at the macula there was a faint star.

The changes at the macula bear a certain resemblance to those in the last case. The sections also showed :—

(i) The thrombosed vessel on the side of the disc.

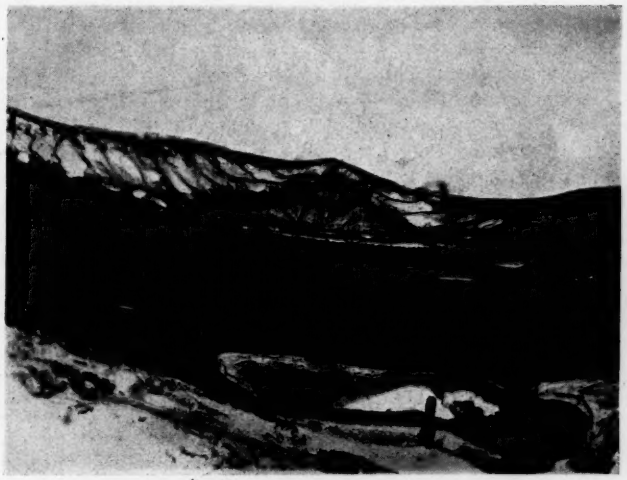


FIG. 4.

(ii) Slight cupping of the disc.

(iii) Some small haemorrhages in the inner layers of the retina.

(iv) Two-thirds of the way between disc and macula a small collection of coagulated fluid between the choroid and rod and cone layer of the retina. Owing, presumably to the degenerate state of the retina, one could not make out the retinal pigment layer in the same way as in the last case.

(v) At the macula (*vide* figure 4) a much larger collection of exudate, the retina here showing advanced cystic degeneration which beyond the macula can be seen to start in the outer reticular layer.

There is no macular hole present in this specimen, but one

cannot help feeling that if the condition had lasted a little longer the retina might have degenerated still further and a hole would have formed, and possibly a cyst have developed in the sub-retinal exudate.

The first series of sections would seem to support the theory that a hole at the macula is due to sub-retinal oedema, and the second shows degeneration affecting an area of the retina separated from the choroid by a layer of oedema. Despite this, however, the whole pathology of the condition would not yet appear to be settled, since there are still two points to determine; first, the source of the oedema, and secondly, why it should be localized to the macular and sub-macular region.

Considering first of all the points in favour of the oedema arising from retinal vessels. They are as follows:—

(i) In both cases there is an obvious source of retinal venous congestion in the form of the thrombosed vein.

(ii) In the second series of sections in the peripheral part of the retina, the degeneration was seen to start in the outer reticular layer. Now Leber showed that this part of the retina is supplied by the terminal branches of the retinal vessels, and would therefore be most sensitive to any changes in the retinal circulation.

(iii) Coats, in discussing the pathology of retinal disease with massive organization, states that the haemorrhages found in the early stages of this disease occur in the outer layers of the retina and break through into the sub-retinal space. If blood takes this path, it is possible for oedematous exudate to do so too.

Now turning to the points in favour of a choroidal origin for the oedema, we have the following:—

(i) The oedema is localized to the macular and sub-macular regions, while the macular portion of the retina is poorer in retinal capillaries than any other part, the fovea centralis being devoid of them and dependant on the chorio-capillaris for its blood supply.

(ii) Leber showed that the calibre of the choroidal capillaries is greatest at the macula and that the chorio-capillaris is thicker here than elsewhere. Arguing from the fact that this portion of the choroid is entirely responsible for the nourishment of the most functionally active part of the retina, one would expect the walls of the choroidal capillaries to be more permeable here than elsewhere so as to allow of the maximum transudation of nutrient materials. This being so, one would expect this part to be the first to suffer from the action of any toxin.

(iii) Hepburn, in the *Royal London Ophthalmic Hospital Reports*, Vol. XVIII, page 92, suggested the grouping of the posterior ciliary vessels into three separate divisions showing an absence of anastomosis with each other, one of these groups being destined solely for the macular region of the chorio-capillaris.

This arrangement would account for the limitation of the oedema to the macular region.

(iv) In the first series of slides the oedema is most marked in the space between the rods and cones and the pigment epithelium. Now, in papilloedema the condition which Paton and Gordon Holmes have shown is due to obstruction to retinal venous and lymphatic return, oedema, when it occurs in the form of a macular fan is due to superficial vesicles which are formed by the raising of the membrana limitana interna from the nerve fibre layer.

(v) Finally, there is the point about the external molecular layer representing that part of the retina which would degenerate first in a case of deficient circulation through the retinal vessels. It is also the part likely to be first affected when cut off from the chorio-capillaris by a layer of oedema, since it is further away from the choroid than any of the other retinal layers which depend on this structure for their nutrition.

I would suggest, therefore, as a possible way out of the difficulty that in these two cases we have a toxic influence—shown by the presence of the irido-cyclitis—acting on the retinal veins causing thrombosis and acting on the delicate macular choroidal capillaries causing degeneration of their walls, increased permeability to fluid, and consequent oedema. This fluid then diffuses or osmoses through into the potential space between the rods and cones and the pigment epithelium, preventing the access of nutrient materials from the chorio-capillaris so that the superjacent retina degenerates and forms a hole.

In traumatic cases, it may be possible to reconcile the theory of Menteith Ogilvie with the oedema theory by regarding the macular chorio-capillaris as the meeting point of the radiating lines of force passing from front to back of the eye. Then, bearing in mind the delicacy of these capillaries, one can understand that if oedema is to be caused anywhere it should be here, and once the macular region of the retina has become separated from its source of nutrition it degenerates and forms a hole.

This seems to be going a long way round to explain the pathology of these cases, especially in the non-traumatic examples, but I can think of no other explanation which would account for the limitation of the oedema and for its occurence in the sub-retinal space.

In conclusion I am indebted to Mr. Mayou and Mr. Levy for their kind permission to use material derived from their cases in the preparation of the accompanying photographs, and to Mr. Mayou for valuable advice as regards this paper.

COUNCIL OF BRITISH OPHTHALMOLOGISTS

A Report on some Public Authorities who are in the habit of referring Ophthalmic Cases to Hospitals for Examination, Treatment, and (or) Report.—*Continued from page* 527, 1921.

In further pursuance of the matters dealt with in this Report the following communication has been received from the Postmaster-General:—

To the Hon. Secretary, Council of British Ophthalmologists.

SIR,—In reply to your letter of the 17th instant, I am directed to inform you that the Postmaster-General has no authority to provide for any of his employees medical advice or treatment beyond those normally given by a general medical practitioner.

Where a Medical Officer of the Department considers it desirable that a Post Office patient should in his own interest seek specialist advice or treatment, he informs the patient of the fact and advises him as to the means of obtaining it.

Where the Department for its own purposes desires specialist advice, it selects a specialist for the particular case in question, and pays him a fee in the ordinary way; but there are not sufficient cases of this kind in any one district to warrant the regular appointment of a specialist.

I am, Sir,
Your obedient Servant,
(Signed)—C. L. M. PEEL,
(*For the Secretary*).

Police Force of Great Britain

Continued from page 526, 1921.

In further pursuance of the matters dealt with on the above subject, a further communication was sent to the Home Office, as follows:—

To the Home Secretary,

3rd November, 1921.

SIR,—The Council of British Ophthalmologists has had its attention drawn to the large number of Police Officers and recruits sent to the hospitals for ophthalmic advice, treatment, or report.

The Council understands that the Watch Committees of the various counties and boroughs provide medical treatment for their Police Officers with the object of ensuring efficiency in the performance of their duties.

The Council notes that with few exceptions (e.g., Borough of Leeds), no ophthalmic surgeons are appointed to whom Police surgeons can refer eye cases, and it further considers that the

efficiency of a Police Force cannot be maintained without such assistance.

The Council feels that a medical report on which presumably official action may be taken should, in justice to all concerned, be given only by those officially appointed by the Police Authorities for that purpose.

After due consideration the Council desired me to forward you the following resolution :—" The Police Medical service cannot be adequate unless it includes the services of ophthalmic surgeons to whom recruits and officers can be referred for expert opinion, treatment, and report."

Yours faithfully,
(Signed)—M. S. MAYOU,
Hon. Secretary.

The following reply has been received :—

The Hon. Secretary, Council of British Ophthalmologists.

23rd November, 1921.

SIR,—I have laid before the Secretary of State your letter of 3rd November and the Resolution passed by the Council of British Ophthalmologists suggesting the appointment of ophthalmic surgeons in all Police Forces, and I am directed by him to say in reply that he is fully alive to the importance of securing proper advice in ophthalmic cases. He thinks, however, that in the Metropolitan Police the requirements are met by the present arrangements. In the County and Borough Police the matter rests primarily with the local Police Authorities and the Secretary of State cannot insist on the appointment of medical specialists by all local Police Authorities.

I am, Sir,
Your obedient Servant,
(Signed)—EDWARD TROUP.

ANNOTATIONS

A Report on some Public Authorities who are in the habit of referring Ophthalmic Cases to Hospitals for Examination, Treatment and (or) Report.

The relation of public authorities, administering public money, and having large numbers of employees in their service, to hospitals, is one which has always aroused some difference of opinion and has rarely given anything but dissatisfaction to the medical profession.

Primarily to secure the efficiency of the services for which they are responsible, and incidentally for the good of the servants in

their employ, the authorities referred to have found it desirable and necessary to appoint paid medical officers, but have relied for special opinions and special treatment upon the services of the visiting staff of voluntary hospitals. No doubt this course has been the more readily adopted by reason of the fact that the servants of such authorities belong for the most part to the class which is entitled to hospital benefits. The authorities themselves, probably ignorant of the fact that the officers of voluntary hospitals are not salaried, have seen no injustice to the medical profession in making arrangements with the lay hospital managers by which to secure benefits for their servants. The British Medical Association has for some time been opposing all such arrangements and demanding that when public money is received for work done in the public interest in voluntary hospitals, some proportion of the payment should be allocated to the medical staff to be disposed of as they think fit.

Quite lately we understand that the Central Hospital Council has been moving in the same direction with regard to payments made by Approved Societies under the Insurance Act for benefits conferred on their members by hospitals. In regard to such services at the Post Office, and the many Police Forces of the Kingdom it appears obvious that the help of ophthalmic surgeons is essential to efficiency. Adequate investigation of the eyes of such public servants is necessary—the refraction as well as the visual acuity of recruits for the Police Force or of postal servants needs to be determined if a force is to be efficient for the purpose for which it is maintained, and if injustice to its members is to be avoided. Cases of visual incapacity for duty arise frequently, and the cause of the incapacity cannot be ascertained by the medical officers who are responsible.

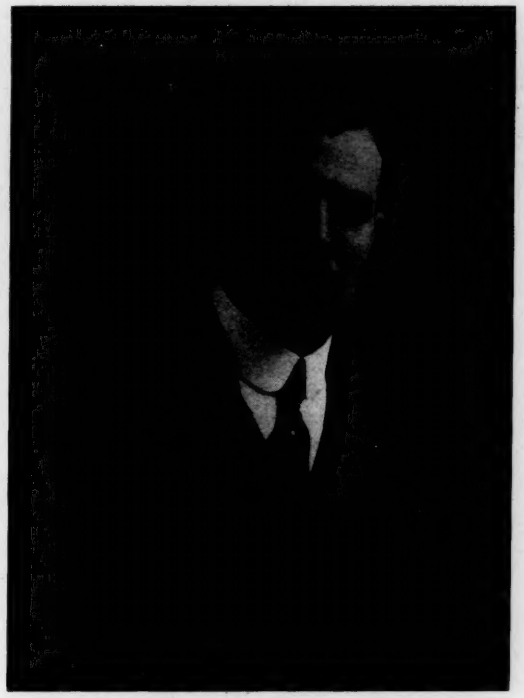
Ophthalmic surgeons attached to hospitals should, in our view, decline to give opinions upon which disciplinary or other action may be taken, involving, as it may, the loss of the means of livelihood or the sacrifice of a pension by the unsuspecting patient visiting the hospital with an introductory note from the medical officer of the body of which he is a member, nor can we see any reason why members of the medical profession should pay their contributions to public funds, and, in addition, give their time and services for such public work.

We are glad to know that the Council of British Ophthalmologists has lately been taking this matter into its consideration, and are sorry to learn that the representations they have made in the proper quarters have received nothing better than the usual bureaucratic response. We trust that they will carry this matter further, in the interests of all concerned.

Sir John Herbert Parsons

We feel that it is only right that some special notice should be taken in this Journal of one name that appeared in the list of New Year's honours.

In the world of ophthalmology few names are better known than that of John Herbert Parsons. We who have been associated with him in editing the BRITISH JOURNAL OF OPHTHALMOLOGY



SIR JOHN HERBERT PARSONS

know how much he has done for it since its foundation, and how valuable his services have been as Chairman of the Editorial Committee.

He is one of the founders of the Council of British Ophthalmologists, and one of its most active members.

It would be hard to find any one who has devoted so much time to arduous work on committees appointed by various Government departments and public bodies. Amongst the important posts

he has held, the following may be mentioned:—When the Royal Society was requested by the Government to study the question of glassworkers' cataract, Parsons was appointed a member of the committee, and was its secretary. He was a member of the Departmental Committee on Sight Tests appointed by the Board of Trade, and served this Department nine years as examiner for the special sight tests examinations for the Mercantile Marine. He was also member of the Departmental Committee on Factory Lighting appointed by the Home Office. During the war, after first acting as Captain in the R.A.M.C., he was promoted to be Colonel in the Army Medical Service as Consulting Ophthalmic Surgeon to the Forces, and still serves the War Office as a member of the Appeal Board for Sandhurst and Woolwich Cadets, and the Air Ministry as a member of the Advisory Medical Council. He was the representative of the Royal College of Surgeons at the Conference called by Scotland Yard to advise on the sight tests for motor drivers.

He is the Chairman of the Committee of the Illuminating Engineering Society to advise the London County Council on the Lighting of Cinemas, and is the representative of the Royal College of Surgeons on the Departmental Committee appointed by the Ministry of Health on the Causes and Prevention of Blindness.

But it is especially his work on more purely ophthalmic lines that has given him his wide-spread reputation. His well-known Pathology of the Eye is alone in its class, and his treatise on Colour Vision is by far the soundest and most scientific work on the subject in the English language, while his Text Book of Ophthalmology is a prime favourite among medical students of the present day.

Last May he was made a Fellow of the Royal Society, and the recent honour of Knighthood conferred on him is one which will gratify everyone who knows him.

ABSTRACTS

I—LIGHTING IN FACTORIES AND WORKSHOPS

Second report of the Departmental (Home Office) Committee on Lighting in Factories and Workshops. London: H.M. Stationery Office.

The Committee on lighting in factories and workshops, originally appointed in 1913, has recently issued a second report. The first interim report appeared in 1915 and dealt with the question

of industrial lighting generally, and recommended adoption of definite regulations in regard to adequate and suitable lighting.

The present report deals at greater length with the details of what constitutes suitable illumination chiefly with regard to glare, shadow, and constancy. Glare was defined in the first report so as to include three phenomena. 1. The effect of looking directly at a bright light. 2. The effect produced by bright sources of light towards the edge of the field. 3. The effect produced by reflection from a shiny surface. As regards suitable shading for direct sources of light the Committee suggest as a reasonable compromise to the complicated measurements required to give a certain candle-power to the square inch that the shade should be such that no detail of filament or mantle can be seen through it. So far as glare is concerned only those lights in or near the direct line of vision need be screened. As regards sources of light not in the direct line of vision the points to be considered are the distance and the angle. It is suggested that for the sources of light in general industrial use 100 feet will be too remote for any injurious quantity of light to reach the eye. The Committee recommend the adoption of the following five provisions.

1. Every light source (except one of brightness not exceeding five candles per square inch) within a distance of 100 feet from any person employed shall be so shaded from such person that no part of the filament, mantle or flame is distinguishable through the shade, unless it be so placed that the angle between the line from the eye to an unshaded part of a source and a horizontal plane is not less than 20 degrees, or in the case of any person employed at a distance of 6 feet or less from the source, not less than 30 degrees.

2. Adequate means shall be taken, either by suitable placing or screening of the light sources, or by some other effective method, to prevent direct reflection of the light from a smooth or polished surface into the eyes of the worker.

3. Adequate means shall be taken to prevent the formation of shadows which interfere with the safety or efficiency of any person employed.

4. No light sources which flicker or undergo abrupt changes in candle-power in such manner as to interfere with the safety or efficiency of any person employed shall be used for the illumination of a factory or workshop.

5. That as regards existing installations a reasonable time limit should be given before the above requirements become operative.

The Committee have also investigated the questions of the diversity, i.e., the ratio of maximum to minimum illumination; contrasts, due to difference of surface brightness; colour and composition of the light. They do not, at present feel able to make any definite recommendations on these points.

An appendix to the report contains extracts from various codes of American States bearing on the above points, and also a summary of the recommendations recently made by the Illuminating Engineering Society in Germany.

The Home Office has supplemented the report by the recent publication of a Welfare Pamphlet on Lighting in Factories and Workshops giving readable explanations of the principles of good lighting and the best means of carrying them out in practice. It is illustrated by photographs and contains in an appendix some information on the measurement of illumination.

An excellent summary of the whole question is contained in the *Illuminating Engineer* for October, 1921.

E. E. H.

II—AMERICAN SPECIFICATIONS FOR MOTOR HEADLIGHTS

American specifications for motor headlights. The *Illuminating Engineer*, Oct., 1921.

Dr. C. H. Sharp presented the interim report of the Committee of the American Illuminating Engineering Society (dated June, 1920) on the above subject to the International Illumination Commission at Paris in July, 1921. The Report covers:—1, Performance on the road; 2, laboratory tests; 3, supplementary regulations for motor-car headlights. The following summary is taken from the *Illuminating Engineer* of October, 1921.

1. Performance on the Road.

" For the purpose of test, the intent of the law governing the headlights of motor vehicles other than motor-cycles and tractors is deemed to be complied with if so adjusted, arranged and operated as to meet the following conditions:—

Any pair of headlamps under the conditions of use shall produce a light which, when measured on a level surface on which the vehicle stands at a distance of 200 feet directly in front of the car, and at some point between the said level surface and a point on a level with the centres of the lamps, is not less than 4,800 apparent candle-power.

Any pair of headlamps under the conditions of use shall produce a light which, when measured at a distance of 100 feet directly in front of the car, and at a height of 60 inches above the level surface on which the vehicle stands, does not exceed 2,400 apparent candle-power, nor shall this value be exceeded at a greater height than 60 inches.

Any pair of headlights under the conditions of use shall produce a light which, when measured at a distance of 100 feet in front

of the car, and seven feet or more to the left of the axis of the same, and at a height of 60 inches or more above the level surface on which the vehicle stands does not exceed 800 apparent candle-power.

Any pair of headlamps under the conditions of use shall produce a light which, when measured on a level surface on which the vehicle stands at a distance of 100 feet ahead of the car, and at some point between the said level surface and a point on a level with the centres of the lamps and seven feet to the right of the axis of the car, is not less than 1,200 candle-power.

2. Laboratory Tests of Headlighting Devices.

For the purpose of test representative samples of headlights are to be furnished by the State authority to the testing authority, with front glasses of nine inches diameter when practical. Reflectors are to be of 1.25 inches focal length, and as nearly paraboloid as possible, and incandescent lamps are also to be of standard manufacture as approved by the National Bureau of Standards. Each device must bear a distinctive mark, and lamps must bear the manufacturer's normal clear bulb rating. The device, when tested, is to be adjusted in accordance with printed instructions issued by the manufacturer.

The nature of the tests is then prescribed. A pair of testing reflectors mounted similarly to the headlights of a car are set up in a dark room and fitted in turn with lamps of vacuum type, 6-8 volts, 15 scp., and gas-filled type 6-8 volts, 21 scp., adjusted to give their rated candle-power and efficiency. If a testing distance of 100 feet is taken reflectors shall be 28 inches apart; for shorter distances proportionately nearer.

Test (1).—6-point Test of Pair of Samples.

(A) In the median vertical plane parallel to the lamp axis on a level with the lamps, (B) in same plane one degree of an arc below level of lamps, (C) in same plane one degree of an arc above level of lamps, (D) four degrees of arc to the left of this plane and one degree of arc above level, (E) four degrees of arc to right of this plane and level with the lamps, (F) four degrees to left of this plane and two degrees of arc below level of lamps.

For points A and B the candle-power shall not be less than 4,800; for C not more than 2,400; for D not more than 800; for E and F not less than 1,200 at one of these points or some point between them.

Devices must comply with the above requirements in order to be recommended for certification; but if requirement could be secured with a lamp of higher candle-power than the values stated above, this fact shall be notified."

E. E. H.

III—SCOTOMATA IN CHRONIC GLAUCOMA

Delorme (Clermont-Ferrand).—Scotomata in chronic glaucoma. (Les Scotomes dans le glaucome chronique.) *Arch. d'Ophtal.*, July-August, 1919.

This paper is the result of a prolonged study of the central light-sense and colour-sense and the occurrence and development of scotomata in the visual field in chronic glaucoma. Much space is devoted to references to and quotations from the writings of various observers since Landesberg in 1889 described central and paracentral scotomata as a clinical symptom of glaucoma.

In the examination of 180 glaucomatous eyes **Delorme** found scotomata in 68. In 2 instances a central scotoma due to macular haemorrhage was present: 25 fields showed the characteristic paracentral scotoma of Bjerrum, crescentic in shape, concave towards the fixation point and continuous above and below with the blind spot of Marriotte. In 4 cases the scotoma was annular (two of these in the two eyes of one individual), the punctum caecum being included in the blind band. In 3 cases a scotoma was present in the temporal part of the field, outside the paracentral area.

Delorme attaches great importance to the typical Bjerrum scotoma in the diagnosis of doubtful cases: he considers it almost pathognomonic of glaucoma.

The paper is illustrated by a number of perimetric charts.

J. B. LAWFORD.

IV—LENS OPACITY ASSOCIATED WITH THE PRESENCE OF COPPER IN THE EYE

Wirths.—On lens opacities associated with the presence of copper in the interior of the eye. (Ueber Linsentrübungen bei Anwesenheit von Kupfer im Augeninnern.) *Zeitschr. f. Augenheilk.*, Vol. XI, Part iii, p. 165.

The reviewer when in Jerusalem had an opportunity of seeing several cases in which copper had entered the eye. The natives use inferior caps for their old time shot-guns which not infrequently explode and wound the eye. His experience was that if the copper could not be extracted the eye was rapidly lost

from cyclitis or even panophthalmitis. Some years ago he removed an eye containing a piece of brass. It was found embedded in a drop of green pus, showing that some of the copper had become dissolved with the formation of a copper salt. He formed the opinion that copper was very badly tolerated in the eye, far more so than iron. Quite recently he has been able to watch a case for some months in which a bright chip of brass is embedded in the lens. No sign of irritation has been observed, nor does the slight localised cataract show signs of spreading. The cases suggest that copper in the lens is not acted upon, whereas in other portions of the globe it dissolves.

Wirths, working at Rostock, believes that copper in the eye may act upon the lens. Purtscher (*Zentralbl. f. Augenheilk.*, Marz-April, 1918) reported a peculiar change in the lens which he believed was caused by the prolonged presence of copper within the globe. By oblique illumination he observes a grey-white cloud situated in the most anterior layers of the lens. The opacity is central and shows radial tongue-like off-shoots spreading to the periphery. The whole appearance is reminiscent of a sunflower. By transmitted light the lens is perfectly transparent.

Goldzieher had described the same condition, but regarded it as a traumatic cataract. Purtscher has seen two cases of this kind and regards the appearance as pathognomic for the presence of copper in the eye.

Purtscher also observed a peculiar shimmer of the lens figure, but he does not regard this iridescence as in any case characteristic of copper, because it is common in other varieties of cataract.

Kummel and Hillemann have published cases of a similar character. Nothing is known as to the cause of the appearance in the lens, but it would appear that the metal must have been in the eye for a long period without causing any irritation. Goldzieher's case had a 10 years' history, others extended to a year and a half. The author adds a case of his own. In 1916 a soldier was wounded in both eyes by the explosion of a detonator. Two years later the left eye became inflamed and the peculiar lens opacity described was present. X-ray examination failed to show the shadow of a foreign body, and the giant magnet operation was without result. A small pigmented scar in the limbus and one deeper in the cornea were possibly due to the passage of a foreign body. Wirths thinks that it is probable that the eye contained a piece of copper.

T. HARRISON BUTLER.

V—ILLUMINATION IN OPHTHALMOLOGY

Dufour, Marcel (Algiers).—The question of the illumination in ophthalmology. (La question de l'éclairage en ophtalmologie.) *Ann. d'Ocul.*, Vol. CLVI, November, 1919.

The present paper by **Marcel Dufour** is preliminary to the publication of his larger work on optics, and deals with the illumination of the eye for inspection purposes and for operative purposes. He believes in the Nernst lamp with a slit as made by Zeiss, but finds it costly and advises the cheaper method of using a low voltage lamp, say, below 16 volts, with a lens to focus the light on a slit, then with an aspherical lens or a spherical lens furnished with a diaphragm, projecting the light on to the spot to be examined. A concave mirror placed behind the lamp so that the filament is about the optical centre of the mirror helps.

He discusses Gullstrand's simple central ophthalmoscopy, mentioning the valuable help he has obtained from the portable Gullstrand and from the larger, stationary one, but finds a useful substitute for this expensive apparatus by using a lamp of low voltage whose light is projected on to a slit by an ordinary spherical lens, then with another lens, fitted with an iris diaphragm, the light from this luminous slit is collected on a small mirror or a small prism with total reflection, the diaphragm being so regulated that the halo is avoided as far as possible. Close to the small prism is placed a 5 mm. diaphragm through which the observer looks.

As regards lamps for operative work, Dufour puts the Sachs lamp to one side as unsatisfactory, while he finds the lamps of the dentists' projectors awkward as the assistant has to change his position so frequently. He speaks of the Zeiss shadowless light with its arc lamp, three mirrors placed at the apices of an equilateral triangle reflecting the light on to three projectors so that the three beams thus obtained converge on the operative field. Realizing, however, that a strong enough current might not be always available and that so much of the light is wasted, Dufour and his friend L. Verain have constructed a skialytic arrangement which they find very useful. The essential feature of this shadow-dissolving arrangement is that of the Fresnel lights used in lighthouses, *optique cylindrique à échelons de Fresnel*. The source of light used is of small extent, but great intensity, and is so placed that the blaze of light falls upon a group of 50 plane mirrors lining the inner surface of a regular pyramid. In this way the light is cast down on the field of operation, giving no shadows and being capable of orientation in any direction without direct light troubling the surgeons. For general surgery a 100 candle power

lamp is enough. Dufour here again offers a simple substitute for ophthalmic work, four lamps, one at each end of two bars crossing at right angles, with four projectors, each having a spherical mirror, a low voltage lamp of 100 candle power and two spherical lenses joined by a draw-tube. The apparatus can be so regulated by centreing on its axis that the four illuminated fields are superimposable.

Dufour says the secret all through is the employment of luminous sources of small area, but great intensity and lenses of wide aperture.

The article would have been helped by some illustrations.

W. C. SOUTER.

VI—EYE OPERATIONS PERFORMED AT SHIKARPUR, SIND

Holland, B. T.—Notes on 2,412 eye operations performed in a month at Shikarpur, Sind, in January and February, 1921. *Indian Med. Gazette,* June, 1921.

Dr. Holland is a medical missionary of wide repute. From his headquarters at Quetta he goes down every year to Shikarpur for a month's hard gratuitous eye-work, in which he is assisted by relays of medical friends. Thus a staff of two or three surgeons is kept at work throughout. The figures in the title of the paper show what a very busy time they have. There are also some general operations performed, including this year 35 for stone in the bladder.

This year there were 1,203 cataract extractions performed within the month of 29 days, the highest number in any one day being 112. Under the press of work it is not surprising that intracapsular extraction is the method mostly practised, with its very simple after-treatment. It is employed in about 95 per cent. of the cases, and the proportion would be higher, were it not that some of the operating surgeons have had little previous experience of eye-work. They generally perform their first 20 or 30 extractions with capsulotomy before beginning to extract in the capsule.

Among the 1,203 cases there were 9 septic results, i.e., 0.75 per cent. There were not fewer than 8 choroidal haemorrhages, attributed largely to operating on eyes with plus tension, though in the list of operations given there are included 28 preliminary iridectomies for glaucomatous cataract. This serves to illustrate the relative frequency in India of the more rapidly developing cataracts with semi-fluid swollen cortex, which tend to produce glaucoma through shallowing of the anterior chamber.

In two cases in which the lens had fallen back into the vitreous it was successfully removed on the fifth day, after it had risen again into its place.

As regards other eye-work there is not much to be noted. Subconjunctival injections of normal saline are used for a number of affections, including early pannus, trachoma, early corneal opacities, and, particularly, phlyctenular ulcers. For trachoma the routine treatment is with 1 in 100 hydrarg. perchlor., in some cases after scraping with a sharp spoon.

H. HERBERT.

VII—ESTIMATION OF THE REDUCTION OF WORKING CAPACITY IN HEMIANOPIA

Rasquin, E.—On the estimation of the reduction of working capacity in hemianopia. (Considérations sur l'évaluation de la réduction de capacité de travail dans la hemianopsies.) *Arch. Med. belges,* November, 1918.

Rasquin, as chief of the ophthalmic service in the Belgian Military Hospital at Havre, has seen a large number of cases of hemianopia following head injuries. In this paper he deals with the question of the calculation of the reduction in earning capacity that is due to hemianopia, and draws up a scheme for the calculation of pensions. The question is one of considerable importance on account of the large number of cases of hemianopia following head injuries that survive. According to Pierre Marie and Chatelain (*Bull. et Mém. de l'Acad. de Méd. de France,* 1915) 10 per cent. of cranial injuries are affected with hemianopia. The forms of hemianopia met with vary considerably from the classical form, so that for the purposes of this paper Rasquin includes all forms of symmetrical defect of the fields due to lesions of the conducting or recipient apparatus from the level of the chiasma to the cortex; lateral homonymous and heteronymous hemianopia, quadrantic hemianopia, hemianopic scotomata and hemiachromatopsia.

Rasquin gives a brief account of the anatomical considerations that determine the nature of the defect, with special reference to the preservation of the macula and the limits of the defect. He then refers to the discussion that took place at Paris at a meeting of the Ophthalmological Society in 1916 on a special report by Morax. Three different methods of reckoning the amount of loss were recommended.

1. Morax, Moreau and Genet estimate the reduction of working capacity due to a typical hemianopia at 36 per cent.; since the temporal part of the field is twice the size of the nasal, each

quadrant of the former is valued at 12 per cent., and of the latter at 6 per cent. Of the remaining healthy field each nasal quadrant is valued at 10 per cent., and each temporal quadrant at 20 per cent.

2. Genet divides the field into tenths. The two eyes give twenty tenths. The ten first tenths are estimated at 30 per cent. (which corresponds to the retinal loss in an ordinary hemianopia); the other ten tenths are valued at 7 per cent. each.

3. Lagrange takes into account the central vision. He starts with the assumption that total blindness is valued at 120 per cent., 60 per cent. for the central vision and 60 per cent. for peripheral vision. He divides each visual field into four sectors formed by two lines intersecting at the point of fixation, one vertical and one horizontal. He assigns the following values to the several quadrants: inferior quadrants 12, 7, 5, 14; superior quadrants 6, 4, 3, 9. Rasquin is not satisfied with any of these systems; the former takes no account of central vision, and the latter sets too high a value on the participation of the macula. To illustrate this latter point Rasquin postulates a case in which the patient has a homonymous hemianopia complicated by the addition of a quadrantic hemianopia with preservation of the macula. On Lagrange's scheme such a patient would lose 45 per cent., but would, as a matter of fact, be incapable of almost any work.

Rasquin does not consider that the idea that a right-sided hemianopia is worse than a left has any foundation, in fact the left loss gives more trouble in reading.

The present French Guide-barême (Ready reckoner) which has been adopted provisionally by the Belgian Government reckons complete blindness at 100 per cent., but Rasquin considers this too low, and considers that the figure should be 120 per cent. as in Germany. Of this total 100 per cent. should be allocated to peripheral vision, and 20 per cent. to the macula; thus a patient with double hemianopia and loss of macula is estimated at 120 per cent., while if the macula is preserved the figure is reduced to 100 per cent. In reckoning up the different forms of hemianopia certain rules must be borne in mind. A gap in the visual field is more injurious the nearer it is to the point of fixation. Of two defects in the visual field of similar extent and equally near to the fixation point, but one of which is situated in the superior and the other in the inferior part of the field, the former is approximately about half the value of the latter.

The scheme advocated is illustrated by a coloured plate of the visual fields divided into segments in the following way:—1. A vertical line passing through the point of fixation. 2. A curved line in the temporal part of the field cutting off a portion equal to the nasal field and roughly dividing the temporal field into two equal parts. 3. A horizontal line passing through the point of

fixation. In this way the visual field is divided into eight segments, two macular portions, two peripheral nasal portions and four peripheral temporal portions, of which two are superior and two inferior, the internal being the equivalent of the nasal fields. The first part of the sum of two visual fields comprising the nasal part of one eye and the temporal part of the other is reckoned as follows:—6 per cent. for the sum of the two portions corresponding to central vision (3 per cent. for each half). The nasal peripheral field counts for 14 per cent., 5 per cent. being for the upper sector and 9 per cent. for the lower one. The peripheral temporal field is reckoned at 20 per cent., 14 per cent. for the internal segment and 6 per cent. for the external. Just as in reckoning the nasal field in the internal segments the superior part is reckoned at 5 per cent. and the inferior at 9 per cent., while in the external part the superior counts for 2 per cent. and the inferior for 4 per cent. The second half of the sum of the two visual fields counts double:—14 per cent. for the sum of the two macular parts, 10 and 18 per cent. for the nasal sectors, 10, 18, 4 and 8 per cent. for the temporal sectors. Hemiopic scotomata can be reckoned up on the same plan, due attention being paid to their extent, situation and proximity to the point of fixation. A bibliography of recent literature on the subject is appended.

E. E. H.

CORRESPONDENCE

A COLLEGE FOR BLIND GIRLS

To the Editor of THE BRITISH JOURNAL OF OPHTHALMOLOGY

SIR,—May I be allowed to call the attention of my colleagues to the new College for the higher education of blind girls which has recently been opened under the auspices of the National Institute for the Blind. It is situated at Chorley Wood, on the foothills of the Chilterns, some twenty miles from London by road and rail. The building is a fine old mansion standing on high ground on the south border of the wide and beautiful heath which tops that piece of country. The spaciousness of the house, the spread of the grounds with the splendid trees therein, and the openness of the position together make it a place of exceptional interest for a school of this order. It would be difficult to find a place where other senses than sight received so many and such happy impressions.

The College is for the higher education of girls who are totally

blind or have no useful degree of sight. The education will be as liberal as in the best public schools for girls, and the physical and mental development afforded will enable blind girls to live full and active lives at school, at home, and in professions. The principal is Miss Phyllis Monk, M.A., formerly of Girton College, Cambridge, and latterly a mistress of Roedean School, Brighton; with her is associated efficient teaching and house staff.

I have visited the College, and can speak of the excellence of the arrangements for teaching and for the comfort of the girls; also on my visit there accompanied me a lady experienced in domestic affairs, and she was greatly impressed with the domestic arrangements and the evident happiness of the resident pupils. The fees for a place of this order are moderate, and there are some scholarships for girls of promise.

There are (happily) not many blind girls of the professional class, but for these few there can be no better place of education and training than this new College. Miss Phyllis Monk, the principal, will be pleased to receive by appointment any ophthalmic surgeon and others interested to view the College and its arrangements. The address is "The Cedars," Chorley Wood, Herts. The College is ten minutes' walk from the station across the heath, and the London road passes within a hundred yards of the lodge gates.

I am, etc.,

N. BISHOP HARMAN.

HARLEY STREET, W.1,
November 14, 1921.

HOLTH'S IRIDENCLEISIS

To the Editor of THE BRITISH JOURNAL OF OPHTHALMOLOGY

SIR,—In the December number of the BRITISH JOURNAL OF OPHTHALMOLOGY Professor Holth's note to his paper on Iridencleisis seems to imply that in the "*Textbook of Ophthalmic Operations*," which he quotes, we had not recognized the basic principles of his methods.

We ask your permission to point out that the description of his operations appears as part of a section on glaucoma, dealing with filtration through a fistula between the anterior chamber and the subconjunctival tissue, kept open by the presence of a fold of iris (pp. 370, 371), and that under the head of Holth's Operation, we say:—

"Holth attempted to lay down rules to regulate the performance

of this manoeuvre; he aimed . . . at fixing a very small fold of iris under a fold of conjunctiva through an incision just outside the sclero-corneal junction. Sometimes he combined it with an iridectomy, but sometimes no iris was removed. His paper gives so great a variety of methods that it is hardly possible to describe one single plan as ' Holth's Operation.' "

This full quotation will show that we fully understood the underlying principles of the paper, and we express our regret to Professor Holth, if this did not appear obvious to him.

We are, Sir,

Yours very truly,

HAROLD GRIMSDALE,
ELMORE BREWERTON.

HARLEY PLACE, N.W.1,
December 28, 1921.

MERCANTILE MARINE VISION TESTS, ETC.

To the Editor of THE BRITISH JOURNAL OF OPHTHALMOLOGY

SIR,—In your issue of December Dr. A. Greene asks what action the widowed mother of a cadet should take in order to recover the expense she has been put to in having her son trained on the " Conway " under circumstances he details. I should advise her to take no steps at all, and certainly not to throw good money after bad, but I do advise the young man—if he is keen on going to sea—to try another Steamship Company and yet another, and I venture to say he will be ultimately passed and accepted with flying colours if he sits tight and does not reveal the fact that he has already been refused by one Steamship Company on account of his sight. I should not apply at present, as, on account of the slackness of trade, etc., many vessels are laid up and there is no demand for officers. Every ophthalmic surgeon must have met with parallel cases, one very glaring one happened to myself many years ago, an influential county gentleman consulting me on the following point:—He was guardian to a young man and anxious to get him into the Army, but stated to me that the Army authorities had themselves refused him on account of his sight, so he brought him to me to ascertain if they were justified in so doing. Well, I speedily showed him that the sight of his ward's eyes was so bad that they couldn't possibly accept him, and the incident closed.

A few years later this gentleman, consulting me about his own eyes, referring to his ward's case, said, " We got him into the

Army all right," thus stultifying themselves and myself too, who had backed them up.

I remember also another county gentleman with only one eye, and that decidedly myopic, also being accepted by the Army authorities. They make regulations about sight, etc., to which they do not always adhere, so much so that when a young man is brought to me to ascertain whether his vision is good enough for the Army or Navy, and I find that, according to the rules and regulations, he would not quite pass, I say, " Well, according to their rules and regulations he won't be admitted," but they don't always adhere to them, so I should certainly have a try, he may get through," and he often does.

After all, aren't we too particular by far? An officer can get on quite well with a little ocular astigmatism or defect if his brains are emmetropic, but, if he has mental astigmatism or instability, there's the rub.

We don't know whether the immortal Nelson—a Norfolk man —had 6/6, but we do know he had not stereoscopic vision during the most glorious period of his career, and yet managed to beat the Spaniards and his enemies.

(2) Let me just touch on the " Halos of Glaucoma," and their significance, so well brought forward in your issue of November by the man we all owe a deep debt to, viz., Lieut.-Colonel R. H. Elliot, who, with Herbert and Lagrange, has done so much to revolutionize the treatment of chronic glaucoma. Had poor Arthur Pearson put off his dreadful ailment to the present day he would, in the hands of a modern operator—thanks to Elliot and Co.—most probably have retained fair sight to the end of his days, but then there might have been no St. Dunstan's. Halos, as Colonel Elliot mentions, may be due to various conditions and are often of no material importance, though the knowledge that they are frequently an early symptom in glaucoma, may unduly alarm the subjects thereof. I myself often have them, and I remember a very scientific and intelligent medical man who was much troubled with and consulted me about them, but would scarcely be reassured and comforted as to their insignificance in his case, until one day he accidentally got a good dose of atropin into his eyes, which only causing him temporary inconvenience settled his doubts and fears on the matter.

Let me incidentally mention how frequently one comes across a patient with chronic glaucoma, who all along has never experienced any halos.

(3) On " Safety in Ophthalmic Operations," by W. H. Simpson, in your same issue. It is certainly right to be very careful as to securing asepsis, and it's not wrong to err on the safe side.

All reasonable precautions should be taken, but aren't we taking too many? Meddlesome midwifery has long been deplored. May not meddlesome ophthalmology be equally objectionable? e.g., can you sterilize a conjunctival sac by any amount of scrubbing and lavage? It is in direct continuity with the nose by the lacrymal passages; it would be logical, therefore, to train the garden hose on the turbinates, etc.

Quite recently some operators used to tie up the eye to be operated on for 12 hours or so before the operation and see what discharge, if any, was on the pad in the morning. I believe that has largely been given up now. I never did it myself; it always seemed to me to be a way of bringing on a process you specially wished to avoid.

Neither do I wash out the conjunctival sac immediately before operating; I have given it up for years in my endeavour to interfere as little as possible with the integrity of the tissues and not to do anything that is unnecessary. I am old enough, I am sorry to say, to have experienced the antiseptic carbolic steam spray in general surgical operations, and was preciously glad when that method was scrapped; it did not have a very long innings. I do not have a culture taken from the conjunctical sac, but I am careful to ascertain the condition of the lacrymal sac and do not operate when the conjunctiva, lids, etc., are obviously unhealthy. I wait until they are in better order and have much faith in argent. nit. for this purpose; it beats all the new colloid preparations of silver, etc. I do not wear any gas mask or dog muzzle when operating, people who require such should not operate at all, nor do I change my boots or my braces.

But I don't operate in wards in which suppurating wounds, etc., are present. I believe in a healthy environment. That most honest surgeon, Harrison Butler—would that all oculists were equally candid, equally straight and outspoken—laid proper stress on this at the last Ophthalmic Congress at Oxford, where he pointed out that his cases, operated on in different institutions and under somewhat different conditions, did not do equally well.

I believe in a sufficiently large, even, clean-cut incision, and I avoid iridectomy where I can for several reasons. I can't always avoid it. Preliminary iridectomy is a mistake. Why make two bites at a cherry when one will do? Why submit your patient to the risks of two operations when one suffices? Even though you attempt to thoroughly explain it to the patient beforehand, they are generally annoyed to find they see no better after the first operation and that another is necessary.

With an iridectomy I believe the eye is more likely to take on unhealthy action and to suppurate, etc., than without.

Also I believe in quick operating and not exposing the eye to

the open air longer than is necessary, and the fewer instruments one introduces into an eye and the fewer the manipulations the better. Soft matter to any extent should be quickly coaxed or washed out. I have my sterilized normal saline solution ready, but use it as little as possible.

Speed and cleanliness go a long way in operating on eyes, as on the abdomen. Many will remember Lawson Tait's scorn for antiseptics and his brilliant results without them, but he didn't expose his patient's peritoneal cavity for three hours when fifteen minutes were sufficient.

How seldom—almost never—an eye suppurates after iridectomy for acute glaucoma. Yet it is a largish wound, done often in a hurry and without many of the preliminary preparations most modern operators submit their patients to. Why is this? I think the increased vascularity of the acute glaucoma eyes has something to do with it, and doubt whether cocain and adrenalin, by reducing vascularity, do not handicap the eye somewhat. Acute glaucomas are, or were, more frequently operated on under a general anaesthetic than a local one.

I think, at any rate, nothing stronger than a 2 per cent. solution of cocain should be applied, and that not too many times, and that adrenalin had better be omitted.

I have no doubt Mr. W. H. Simpson would have been horrified to see that prince of operators, the late Charles Bell Taylor, of Nottingham, spit upon his instruments to clean them after operating. I have often seen him do it myself and can't say I like it, but his results were good. For pace, dexterity and neatness of manipulation, Stanford Morton was hard to beat, his extractions frequently suggested a conjuring trick. Both he and Bell Taylor objected to iridectomy in cataract extraction. Let me just horrify Mr. Simpson once more by recounting an experience of my own. Many years ago I was doing an advancement for squint under cocain and had divided the muscle and was putting in the sutures with the parts well open when in a flash the child vomited and the vomit went into and all over the operated eye and exposed parts. I cleaned it up with cotton swabs and . . . no eye ever did better!

Yours faithfully,
S. JOHNSON TAYLOR.

BOOK NOTICES

Transactions of the Ophthalmological Society of the United Kingdom. Vol. XLI. Session 1921. London: J. & A. Churchill, 7, Great Marlborough Street. 1921. Price 30s. net.

This handsome volume of 542 pages comprises the proceedings of the Ophthalmological Society of the United Kingdom during its annual congress held in London in May, 1921. It gains added influence from the inclusion of the six affiliated societies, namely, the Oxford Ophthalmological Congress, the Midland Ophthalmological Society, the North of England Ophthalmological Society, the Irish Ophthalmological Society, the Scottish Ophthalmic Club, and the Ophthalmological Society of Egypt. There seems to be some little ambiguity about the name of one of the constituent bodies, which is spoken of as the " Scottish Ophthalmic Club " on the first page of the volume, and " The Scottish Ophthalmological Club " on page xlvi and elsewhere. Noteworthy among the contents is the address by the President, Mr. J. Herbert Fisher, on " The Personal Equation," the Bowman Lecture, by Mr. E. Treacher Collins (noticed at length in our last issue, p. 39), and the report of the discussion at the Oxford Congress on " The Causes of Infection After the Extraction of Senile Cataract," opened by Victor Morax. The volume also contains reports of discussions on the psychology of vision in health and disease, opened by Professor C. Spearman and Mr. Herbert Parsons, F.R.S., and on the treatment of manifest concomitant strabismus, opened by Mr. Claud Worth and Mr. A. J. Ballantyne. The remainder of the volume contains notes of cases and of pathological observations. Most pictures are in black and white, while coloured plates, so conspicuous a feature in former numbers of the *Transactions*, are few in number, doubtless due to their great cost nowadays. As regards its contents, however, they compare favourably with its forty predecessors. It is a credit to British Ophthalmology in general and to the Ophthalmological Society in particular.

The Care of Eye Cases. By Lieut.-Colonel R. H. ELLIOT, M.D. Lond., F.R.C.S. Eng., Lecturer in Ophthalmology, London School of Tropical Medicine, etc. London: Henry Frowde and Hodder & Stoughton. Price 12s. 6d.

This is one of the Oxford Medical Publications and is described as a manual for the nurse, practitioner and student. It contains 168 pages and 135 illustrations, and should prove itself most useful to the beginner, particularly a nurse who is being trained in ophthalmic work. Part I is devoted to:—

(*a*) Surgical remedies, preparations before, and care of patient after, an operation.

(*b*) The description of appliances used in diagnosis.

Part II.—Diseases of the eye and orbit, 16 pages only, is merely an introduction to the subject.

The Appendix includes a list of instruments required for each of the more usual eye operations, and finally 20 illustrated pages of instruments so that the nurse may make herself familiar with their appearance.

The book shows the usual standard of excellence of the Oxford Medical Publications, and should be in every ophthalmic operating theatre.

E. B.

An Index of Treatment. Edited by ROBERT HUTCHISON, M.D., F.R.C.P., and JAMES SHERREN, C.B., F.R.C.S. Eighth edition. Pp. xviii, and 1021. Bristol: John Wright & Sons, Ltd., 1921. Price 42s. net.

Any book which has gone through eight editions in the course of fourteen years has obviously established its position in the world, and a review of it becomes an easy task under these circumstances. The articles in the present edition on diseases of the eye have all been revised by Sir William Lister. Many of them were written for the original publication by him, and others by the late Mr. Ilbert Hancock. We have read them all through and find in them all the same characteristics of well-balanced judgment and sound common sense. The instructions given are such as should enable any good general practitioner to deal with all the ordinary eye diseases that he is likely to wish to treat without more expert help.

The book is adapted for the use of the busy doctor, and the articles are concise, lucid and dogmatic, three points which are sure to gain the busy doctor's approbation.

NOTES

Central Council for the London Blind

IN these columns (page 575) we have already given some details of the council in aid of the blind appointed by the London County Council. The County Council has now appointed Captain O. E. Winburg to be chairman of the newly constituted central council. The chairman and vice-chairman of the County Council's special committee for the welfare of the blind automatically become members of the central council. The County Council has also

appointed the following six persons, with special knowledge of the needs of the blind, to be members of the central council: Mr. A. E. Barber, Mrs. Adolphus Duncombe, Captain Ian Fraser, Mrs. F. W. Hamilton, Mr. Henry Stainsby, and Mr. F. G. Mowatt. It was originally recommended that one representative should be appointed by the Minister of Health, and another by the Board of Education, but the County Council has since been informed that those bodies do not see their way to appoint representatives to serve on the central council, although they were willing to allow representatives to attend meetings informally.

* * *

Death

IT is with much regret that we record the death of Dr. Reginald Anstruther Farrar. A son of the late Dean Farrar, he was medical secretary to the Departmental Committee on the Causes and Prevention of Blindness (Ministry of Health). In that capacity he was indefatigable and did excellent work. He recently retired from the Ministry of Health, and immediately threw himself, with his accustomed energy and enthusiasm, into the relief of famine in Moscow. He had unique experience of plague in India and Manchuria, and of cholera and other epidemic diseases. He succumbed to typhus in Moscow on December 29th. He died in harness at the age of 60, and we feel that it is the end which he himself would have desired. He was a cultured Bohemian of the best type—the friend alike of navvies, fruit pickers, and the poor, and of his brother Savages in more artistic circles.

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An International Congress of Ophthalmology

IT is clearly most important that those who intend to visit the Washington Ophthalmological Congress in April next should reserve their accommodation well in advance. Early hotel reservations may be made by communicating promptly with Dr. W. W. Wilmer, 1610 I Street, N. W. Washington, D.C., U.S.A.

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Appointments

MR. CYRIL JACOBS has been appointed honorary ophthalmic surgeon to the Victoria Memorial Jewish Hospital, Manchester, and oculist to the Cheshire Educational Committee.

* * *

Midland Ophthalmological Society

MR. SYDNEY STEPHENSON has been elected an honorary member of the Midland Ophthalmological Society.